MERCURY JET TARGET RESEARCH AND DEVELOPMENT FOR AGS E-951

C. C. Finfrock and G. A. Greene

Muon Collider Collaboration Meeting

Brookhaven National Laboratory

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Mercury Target Requirements

- Generate a one-centimeter diameter arcing horizontal jet of mercury to provide a 10 to 15-centimeter interaction length with the proton beam.
- Provide an unobstructed view of the interaction zone for high speed imaging.
- Operate simply, reliably and remotely.
- Safely contain projectiles which may be generated by mercury-beam interactions.
- Manage mercury vapor generation.
- Mounting system to provide for easy interchange of other test targets.
- Materials of construction must be compatible with mercury and survive a radiation environment.

Main Features of Pneumatic Mercury Jet Apparatus

- Mercury jet containments:
  - Dual containment assembly for mercury containment
  - External fiducial registration for quick installation and replacement
  - Constructed of commercially available components wherever possible
- Primary containment:
  - Constructed out of commercial vacuum components
  - May be inerted, vented to atmosphere through mercury traps
  - Pressure relief and liquid level sensors on mercury reservoirs
  - Remote pneumatic operation, no active electrical components
  - Interior is mercury wetted, all materials mercury compatible
  - Can be isolated and pressurized for leak testing
  - Beam windows are Inconel 718 and/or Havar

Main Features of Pneumatic Mercury Jet Apparatus

- Secondary containment:
  - Commercially fabricated out of welded stainless steel
  - Air atmosphere, always vented to atmosphere through mercury traps
  - No active electrical components
  - Interior is not mercury wetted, but all components are mercury compatible
  - Interior can be manually sniffed for mercury
  - View ports are quartz, Lexan or ballistic glass
  - Approximate size: 20″ wide x 20″ high x 36″ long

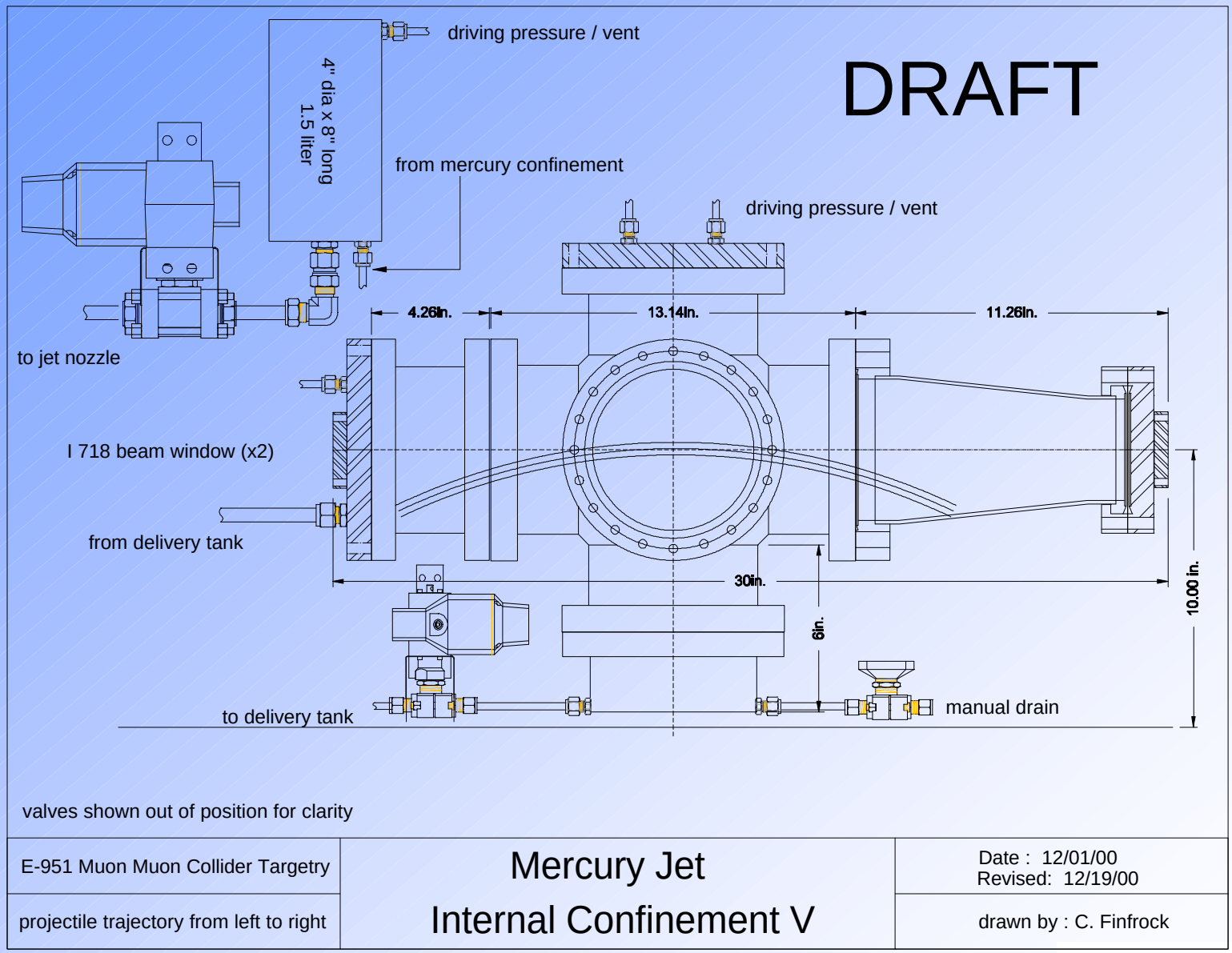
Main Features of Pneumatic Mercury Jet Apparatus

- Mode of operation:
  - Pneumatic operation and control to provide a 5-second duration mercury jet
  - Two-dimensional positioning table is remotely controlled
  - Remote operation of jet apparatus by computer control
  - Minimize beam line entry requirements and radiation exposure
  - Mercury sniffer on hand during operation
  - Visual detection of mercury in secondary containment
  - All components are mercury compatible
  - Radiation resistant materials such as poly-ether-ether-ketone valve seats, ethylene-propylene O-rings and Viton or copper flange gaskets are used
  - Can reset for next test remotely in minutes

Materials Considerations

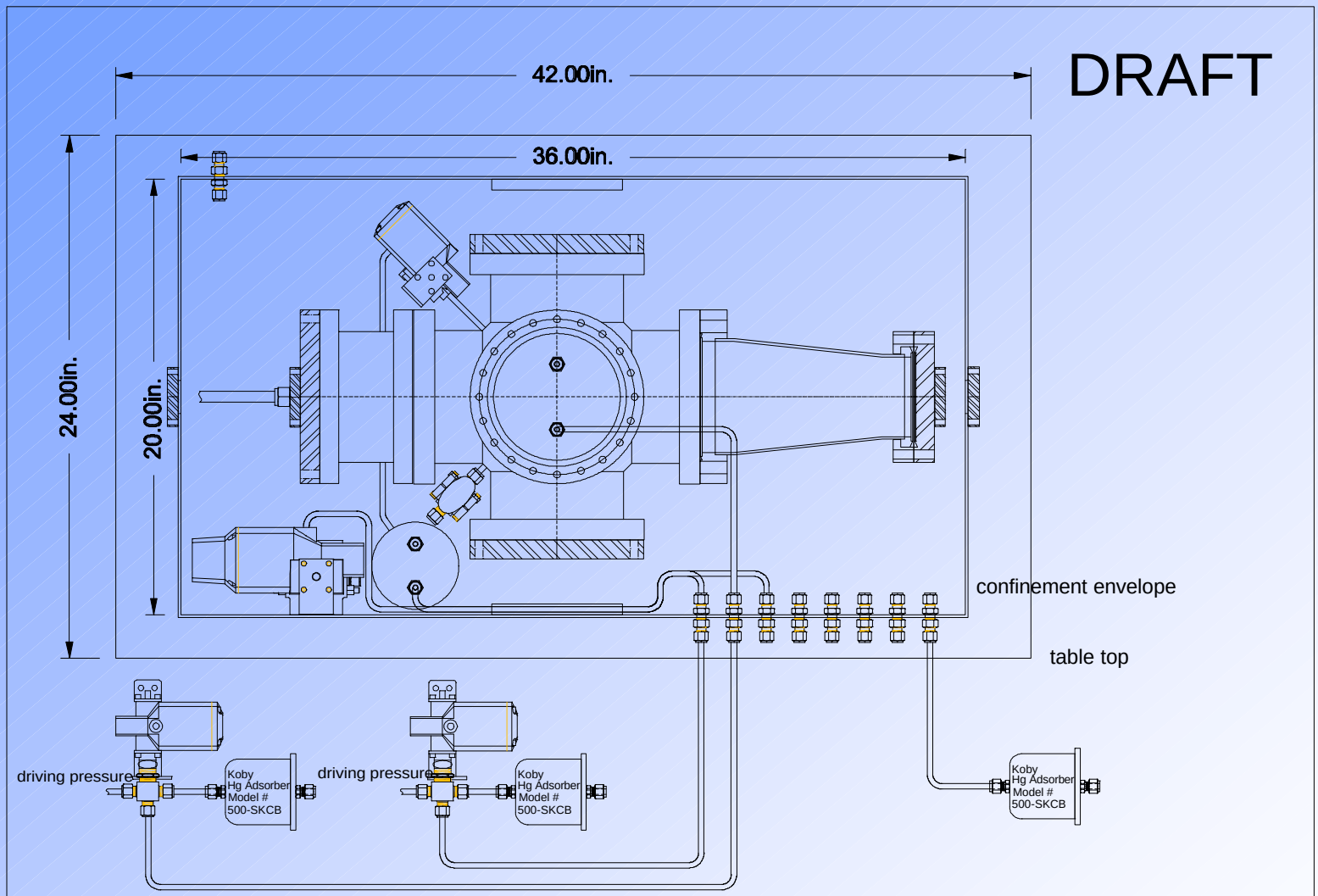
- Containments:
  - Commercially available stainless steel components for inner containment
  - Welded stainless steel sheet for outer containment
  - Inconel-718/Havar alloy external beam windows
  - Quartz, Lexan or ballistic glass internal view ports
  - Quartz, Lexan or ballistic glass external view ports
- Valves:
  - Stainless steel bodies
  - Poly-ether-ether-ketone seats
  - Ethylene-propylene or “grafoil” flange seals
  - Non-fluorocarbon actuators
  - Pressure ratings in excess of 1000 psig

Mercury Jet Internal Confinement, Integral Reservoir Design



E-951 Muon Muon Collider Targetry	Mercury Jet Internal Confinement V	Date : 12/01/00 Revised: 12/19/00
projectile trajectory from left to right		drawn by : C. Finfrock

Looking Into The Secondary Confinement From Above



E-951 Muon Muon Collider Targetry	Hg Jet Component Layout in External Confinement, Plan View	Date : 12/06/00 Revised : 12/14/00
particle trajectory from left to right		drawn by : C. Finfrock

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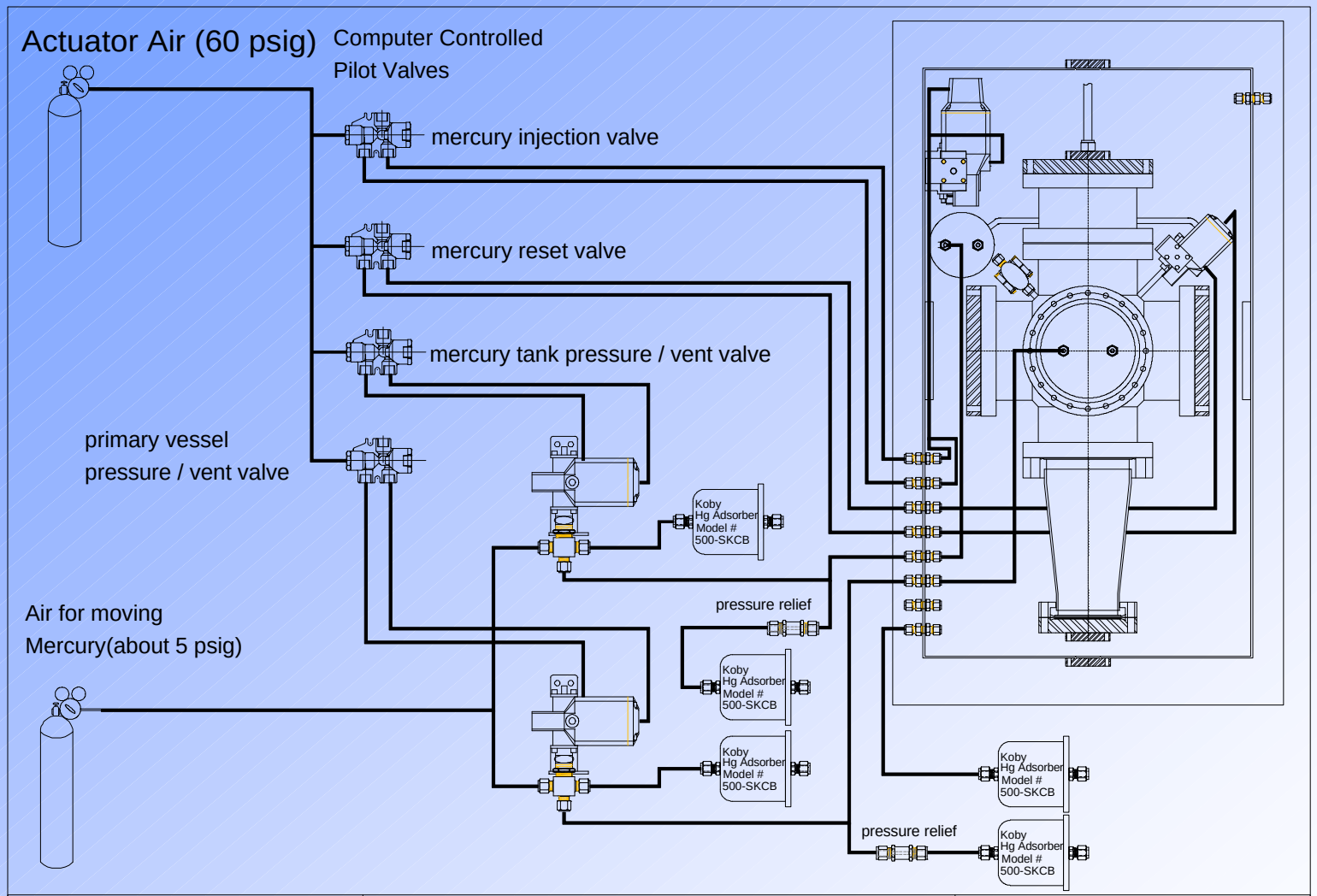
Pneumatic Control System for Mercury Jet



E-951 Muon Muon Collider Targetry	Schematic of Plumbing System	Date : 1/4/01
NOT TO SCALE	DRAFT	drawn by : C. Finfrock

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Current Status

- Preliminary tests with water jets are complete.
- Mercury jet target designs are substantially complete, final detailing still underway.
- Test stand is installed in the beam line.
- Materials procurement underway.